

REMARKS

This paper is being provided in response to the Final Office Action mailed July 26, 2006, in which claims 2-37 and 116-119 are pending in the application. All claims are rejected. The first deadline for responding to this Final Office Action was October 26, 2006. A Petition for a three (3) month extension of time up to and including January 26, 2007, is submitted herewith. A Request for Continued Examination is also submitted herewith. Claims 2-14, 16-37 and 117-119 have been amended. Applicant respectfully submits that the amendments to the claims do not add new subject matter. Claim 15 has been cancelled.

Brief Description of the Invention

The present invention relates generally to microfluidic chemical systems for synthesis and coating of colloidal nanoparticles. Specifically, the present invention integrates microchemical systems to synthesize colloidal nanoparticles, tune their surface properties, composition and crystallinity, into one integrated substrate.

Rejections under 35 U.S.C. § 112

Examiner has rejected claims 15-30, 34, 35, 37, 117 and 118 as being indefinite under 35 U.S.C. § 112.

Regarding claim 15, Examiner states that it is unclear as to what "means" (i.e., what structure and equivalents thereof) corresponds to the "means for employing solution-based sol-gel processing." Claim 15 has been cancelled, without prejudice.

Regarding claims 16-18, 117 and 118, Examiner states that it is unclear as to the structural limitation applicant is attempting to recite because the first, second and third reactant streams are not considered elements of the apparatus, and their respective flow rates are considered process limitations. Regarding claims 34, 35, and 37, Examiner states that it is unclear as to the structural limitation that the applicant is attempting to recite because the "quench fluid" is not considered an element of the apparatus.

Examiner notes that the inclusion of a material or article worked upon by an apparatus does not further limit apparatus claims. Examiner cites to the MPEP § 2115 and reiterates all but

the last paragraph of the section. The last paragraph of the section, however, applies to the present claims. Independent claim 116 is a "system" claim, comprising various articles grouped together (e.g., at least one nanoparticle, inlet channel, micromixing block, aging section and outlet channel, wherein these components all reside on a substrate). See MPEP § 2115 ("Note that [Ex Parte Thibault, In re Young, In re Casey] is limited to claims directed to machinery in its intended use. It does not apply to product claims or kit claims (i.e., claims directed to a plurality of articles group together as a kit.")). The at least one colloidal nanoparticle, reactant streams, and quench fluids are all components of a system and therefore are properly included as material to be worked upon. All remaining dependent claims have been amended to make clear that which the Applicant claims.

Applicant submits that the amendments obviate these rejections. Applicant therefore respectfully requests that these rejections be withdrawn.

Rejections under 35 U.S.C. § 102 and 103

Nikiforov:

Claims 5-7, 9-14, 16-32 and 116-118 are rejected under 35 U.S.C. § 102(b) as being anticipated by Nikiforov (U.S. Patent No. 6,107,044).

The present invention relates generally to microfluidic chemical systems for synthesis and coating of colloidal nanoparticles. Specifically, the present invention integrates into one integrated substrate, various microchemical systems to synthesize colloidal nanoparticles such as Silica, Titania, Alumina or Ceria, tune their surface properties, composition and crystallinity, and control their self-assembly. See, e.g., page 2, lines 22-28 and Fig. 4. For example, as claimed in independent claim 116, the various components of the microreactor system of the present invention comprise at least one colloidal nanoparticle, at least one micromixing block positioned downstream from said at least one inlet channel, an ageing section positioned downstream from said at least one micromixing block, and at least one colloidal nanoparticle, wherein all of the said components reside on one integrated substrate. See, e.g., page 2, line 30-page 3, line 3. The at least one colloidal nanoparticle may be an amorphous or organic oxide such as Silica, Titania, Alumina or Ceria, and all of the said components are microfabricated onto and integrated within

one silicon wafer. *See* page 2, lines 22-28; page 13, line 8-page 15, line 17; page 22, line 1-page 23, line 28; Fig. 4.

Nikiforov discloses a microfluidic system for determining the nucleotide sequence of target nucleic acid sequences. The methods and devices disclosed in Nikiforov mix and separate nucleic acid fragments so as to determine the sequence. Nikiforov does not disclose, teach or suggest the apparatus of the present invention as claimed in independent claim 116. Specifically, Nikiforov does not disclose a microreactor system comprising at least one colloidal nanoparticle, and further comprising an inlet channel, micromixing block, ageing section, and outlet channel residing on one integrated substrate.

Examiner states that the recitation of "at least one colloidal nanoparticle" adds no further patentable weight because the inclusion of a material or article worked upon by an apparatus does not further limit apparatus claims. As stated above, the line of cases cited by Examiner to support this proposition does not apply to the system claims included in the present application. Nikiforov does not disclose, teach or suggest at least one colloidal nanoparticle.

Furthermore, Examiner points to the separation channel portion 210 of Nikiforov as being an "ageing section" as claimed by the present invention. The separation channel of Nikiforov is where various fragments within the nucleic acid mixture are separated by size and/or concentration, thereby achieving the detection of target nucleotide sequences. *See* col. 11, lines 9-11 of Nikiforov. To enable this separation, the separation channel is filled with a polymeric material. *See* col. 5, line 53-col. 6, line 14 of Nikiforov ("In order to optimize separation of nucleic acid molecules, the separation channel generally includes an appropriate separation matrix disposed therein. Typically, such separation matrices include a high molecular weight polymer solution, e.g., between about 5 and 200 Kd, which polymer bears an appropriate charge to nullify or significantly reduce any charge on the wall surface of the separation channel, which can result in excessive electroosmotic flow within the separation channel."). In addition, Nikiforov discloses the use of electrokinetic flows to drive material through the polymeric material/separation matrix within the separation channel. *See, e.g.,* col. 8, line 7-col. 9, line 53. A device as described in Nikiforov does not comprise an ageing channel as claimed by the present invention. The packing material necessary for the separation channel to function, along

with the use of electrokinetic flows to drive the nucleic acid through the separation channel would destroy the intended function of the ageing channel of the present invention. Nikiforov does not disclose, teach or suggest a system comprising an ageing section that provides ageing length for the growing nanoparticles.

Currently pending claims 5-7, 9-14, 16-32 and 117-118 depend from claim 116. Applicant therefore submits that the present invention is not anticipated by Nikiforov, and respectfully requests that these rejections be withdrawn.

Swinehart:

Claims 2, 5-13, 15, 18, 31-33 and 116-119 are rejected under 35 U.S.C. § 102(e) as being anticipated by Swinehart et al. (Patent Publication Number US 2005/0129580). Further, claims 14, 16, 17, 19-30 and 34-37 are rejected under 35 U.S.C. § 103(a) as being obvious over Swinehart. Claim 15 has been cancelled, without prejudice.

Submitted herewith is a Declaration under 37 C.F.R. § 1.131 by a one of the inventors of the present application, Klavs Jensen. Dr. Jensen submits that prior to February 26, 2003 (the earliest priority date of Swinehart), he and his co-inventor conceived of the invention disclosed and claimed in the present application. Thereafter, and also prior to February 26, 2003, they reduced the invention to practice. As such, Applicant respectfully submits that Swinehart is not a proper 102(e) or 103(a) reference, and requests that these rejections be withdrawn.

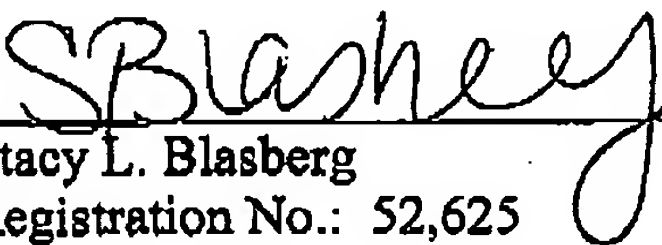
Swinehart in view of Chandler and Yasuda:

Claims 3 and 4 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Swinehart in view of Chandler (U.S. Patent No. 6,506,584) and Yasuda (U.S. Patent No. 6,244,738). As stated above, submitted herewith is a Declaration under 37 C.F.R. § 1.131 by a one of the inventors of the present application, Klavs Jensen. Dr. Jensen submits that prior to February 26, 2003 (the earliest priority date of Swinehart), he and his co-inventor conceived of the invention disclosed and claimed in the present application. Thereafter, and also prior to February 26, 2003, they reduced the invention to practice. As such, Applicant respectfully submits that Swinehart is not a proper prior art reference. Chandler discloses an apparatus and

method for ultrasonically treating a liquid to generate a product. Yasuda discloses an apparatus for mixing and stirring a fluid in a channel by radiation and ultrasound. Neither Chandler nor Yasuda, either alone or in combination, disclose, teach or suggest the apparatus of the present invention as claimed.

Based upon the above, Applicant respectfully requests that the Examiner reconsider and withdraw all outstanding rejections and objections. Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 617-248-4054. Please charge any fees associated with this filing, or apply any credits, to our Deposit Account No. 03-1721.

Respectfully submitted,


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